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Title: AXIAL-FIELD, SHADED-POLE HYSTERESIS MOTOR ;

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IPC Classification: H02K19/08 ;

Equivalents: ;

ABSTRACT:

In shaded-pole hysteresis synchronous motors of the planar air-gap type, the stator laminated core 1 is U-shaped and is made of grain-oriented steel laminations which have higher permeability and lower loss. Each pole face is physically divided into two or three segments with the smaller segment(s) surrounded by short-circuited shading coil(s) 3. The rotor 4 is of the solid disc type and is made of hardened magnetic material (such as an alloy of steel containing chromium or cobalt) with or without a non-magnetic supporting disc (such as a brass disc) 5.

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(54) Axial-field, shaded-pole hysteresis motor

(57) In shaded-pole hysteresis synchronous motors of the planar air-gap type, the stator laminated core 1 is U-shaped and is made of grain-oriented steel laminations which have higher permeability and lower loss. Each pole face is physically divided into two or three segments with the smaller segment(s) surrounded by short-circuited shading coil(s) 3. The rotor 4 is of the solid disc type and is made of hardened magnetic material (such as an alloy of steel containing chromium or cobalt) with or without a non-magnetic supporting disc (such as a brass disc) 5.

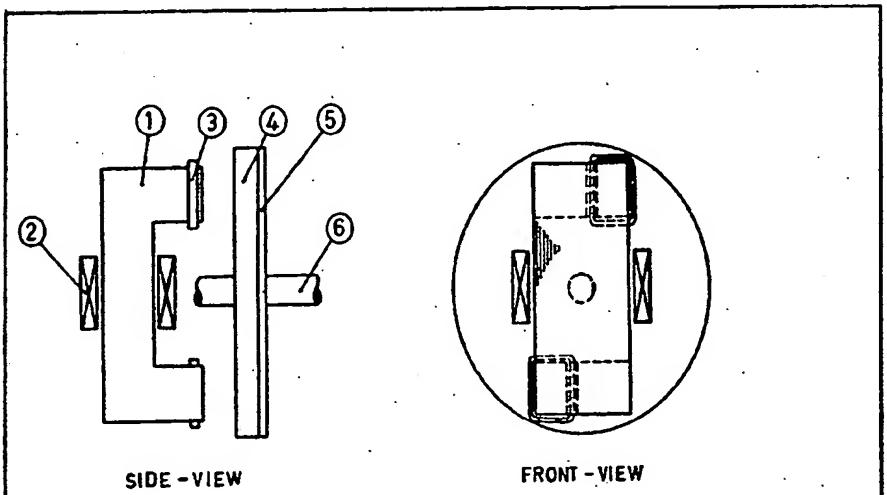

FIG.1 AXIAL-FIELD SHADED-POLE HYSTERESIS MOTOR

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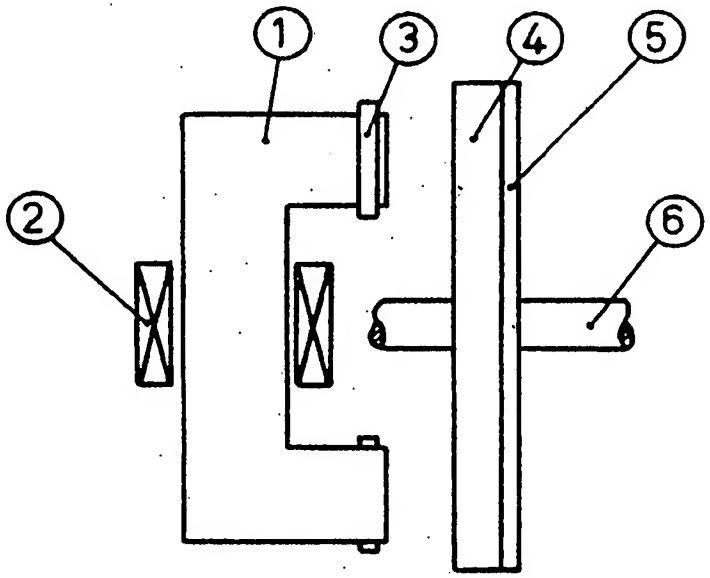
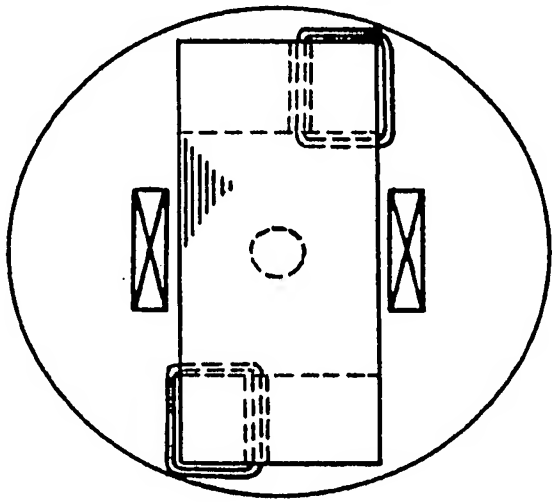


SIDE - VIEW



FRONT - VIEW

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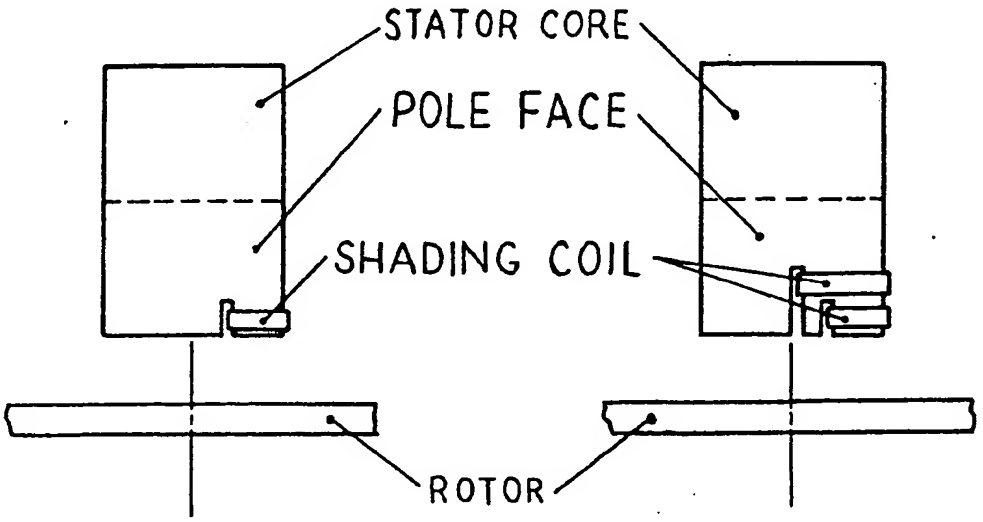
(1) STATOR CORE (2) STATOR COIL (3) SHADING COIL

(4) MAGNETIC ROTOR DISC (5) NONMAGNETIC SUPPORTING DISC (6) SHAFT

FIG.1 AXIAL-FIELD SHADED-POLE HYSTERESIS MOTOR



(A)
WITH SINGLE SHADING COIL

(B)
WITH DOUBLE SHADING COIL

FIG. 2 SHADED-POLE

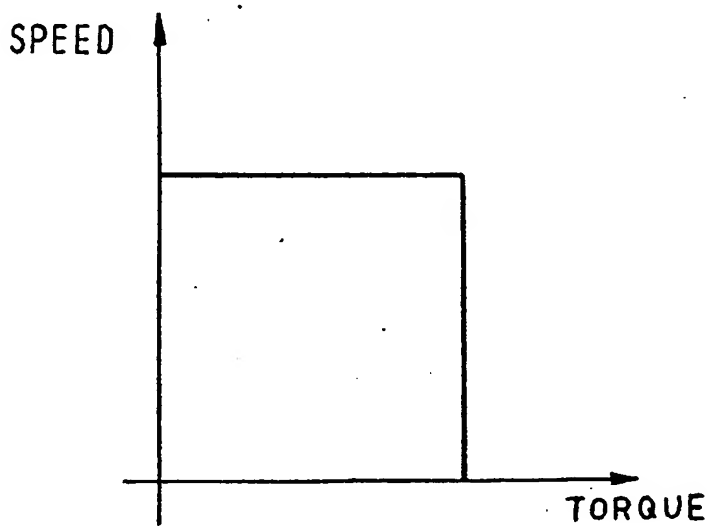


FIG. 3 IDEAL SPEED-TORQUE CURVE OF HYSTERESIS MOTOR

SPECIFICATION

Axial-field shaded-pole hysteresis motor

This invention relates to a new design of construction for shaded-pole hysteresis motors of the planar airgap type. It differs from conventional hysteresis motors in that:— (1) the airgap flux is predominantly axial, (2) the stator has a U-shaped laminated core and (3) the rotor is of the disc type.

Fig. 1 shows the basic construction of the axial-field shaded-pole hysteresis motor. For clarity, the mechanical details have been omitted. The construction of both the stator and rotor is simpler than that of the conventional hysteresis motor. The U-shaped stator core is made of grain-oriented steel laminations which has higher permeability and lower core loss. Each pole face is physically divided into two segments with the smaller segment surrounded by a short-circuited solid copper shading coil (Fig. 2a). Alternatively, to improve the waveform of the airgap magnetic field, each pole face may be physically divided into three segments with the two smaller segments surrounded by shading coils (Fig. 2b). The stator coil is located at the pole yoke. The rotor is of the solid disc type and made of hardened magnetic material with or without a supporting disc made of nonferromagnetic material such as brass. The hardened magnetic material is an alloy of steel, such as Fe-Co-V (52% Co, 3.5 to 13% V), Fe-Co-Mo (12% Co, 11 to 17% Mo), Fe-Ni-Mn (3 to 12% Ni, 3 to 12% Mn plus additional Ti, Mo and V), Fe-Co-W (11 to 13% Co, 13 to 15% W), Fe-Co-W-Mo (16% Co, 10% W, 5% Mo), Fe-Ni-Al-Nb (25% Ni, 9% Al, 4% Nb), Fe-Co (35% Co), Fe-Cr (3.5% Cr), alnico (Fe-Ni-Al-Co), etc.

In the design of this invention, the outer diameter and inner diameter of the rotor core are determined by the power, speed, specific magnetic loading and hysteretic angle of the rotor magnetic material. The thickness (axial-length) of the disc rotor magnetic core is determined by the airgap flux density and the optimum flux density in the rotor magnetic core.

The principles of operation of this invented hysteresis motor is similar to that of conventional hysteresis motor. Essentially it is a synchronous motor without d.c. excitation. It starts and runs by virtue of the hysteresis losses in its rotor core induced by the stator sweeping field and it operates normally at synchronous speed due to the retentivity of the rotor core.

Fig. 3 shows the theoritical speed-torque characteristic motor. In the shaded-pole hysteresis motor, the practical speed-torque characteristic departs somewhat from the theoritical characteristic because its airgap field is a sweeping field rather than a circular rotating field, and because harmonics are present in the airgap field.

Compared with the conventional hysteresis motor, the main advantages of this invented axial-field hysteresis motor are:

1. The simplicity in construction and robustness of both the stator and rotor resulting in the higher reliability.
2. The higher utilization factor of the rotor core and the use of grain oriented steel for the stator core resulting in the higher power-to-weight ratio and lower rotor inertia.
3. The ease of the fabrication of the stator core and rotor core and the saving of the material of these cores resulting in a reduction of the cost.
4. The complete axial separation between stator and rotor resulting in the ease of assembling and the ease of airgap adjustment.
5. The disc-shaped rotor offerring a distinct advantage for certain applications, such as turntables, gyroscopes, etc.

CLAIMS

1. An axial-field shaded-pole hysteresis motor with a U-shaped stator laminated core and a disc-typed solid rotor.
2. An axial-field shaded-pole hysteresis motor according to Claim 1 wherein considerable saving is achieved through (a) the simplicity of construction, (b) the ease of fabrication, (c) the use of grain-oriented steel for the stator core, and (d) the higher utilization factor of the rotor core.
3. An axial-field shaded-pole hysteresis motor according to Claims 1 and 2 wherein considerable reduction of cost is achieved.
4. An axial-field shaded-pole hysteresis motor according to Claim 1 wherein higher reliability is achieved through the simplicity and robustness of the construction.

CLAIMS (18 May 1981)

1. An axial-field shaded-pole hysteresis motor with a transformer type stator core which is made of separate sides using grain-oriented steel laminations.
2. An axial-field shaded-pole hysteresis motor according to Claim 1 wherein simplicity and robustness in construction are achieved.
3. An axial-field shaded-pole hysteresis motor according to Claims 1 and 2 wherein lower production cost and higher reliability are achieved.

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